

# Television Viewing and Long-Term Weight Maintenance: Results from the National Weight Control Registry

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**Key words:** television, weight loss maintenance, National Weight Control Registry

## Abstract

**Objective:** To examine the role of television (TV) viewing in long-term maintenance of weight loss.

**Research Methods and Procedures:** All subjects ( $N = 1422$ ) were enrolled in the National Weight Control Registry (NWCR), a national sample of adults who have maintained a minimum weight loss of 13.6 kg for at least 1 year. Participants self-reported the average number of hours of weekly TV viewing at entry into the NWCR and at a 1-year follow-up. Cross-sectional and prospective analyses were performed to determine the frequency of TV viewing and the extent to which TV viewing was independently associated with weight regain over the 1-year of follow-up.

**Results:** A relatively high proportion (62.3%) of participants reported watching 10 or fewer hours of TV per week on entry in the NWCR. More than one third of the sample (36.1%) reported watching  $<5$  h/wk, whereas only 12.4% watched  $\geq 21$  h/wk, which contrasts markedly from the national average of 28 hours of TV viewing per week reported by American adults. Both baseline TV viewing ( $p \leq 0.02$ ) and increases in TV viewing ( $p \leq 0.001$ ) over the follow-up were significant predictors of 1-year weight regain, independent of physical activity and dietary behaviors.

**Discussion:** Individuals who are successful at maintaining weight loss over the long term are likely to spend a relatively minimal amount of time watching TV.

## Introduction

There is increasing recognition that sedentary behaviors, particularly television (TV)<sup>1</sup> viewing, may play an important role in long-term weight regulation. This attention is attributable to the fact that the recent epidemic of overweight and obesity has occurred in parallel with a significant increase in the role of TV, VCRs, and DVDs in the daily lives of most Americans. With the exception of work and sleep, TV viewing consumes more time than any other behavior in the United States (1). American adults spend an average of 4 h/d watching TV (2). Moreover, TV viewing has been positively associated with overweight status in several cross-sectional (3,4) and prospective studies (5,6), and this association is independent of level of physical activity. Although there are apparently no published experimental studies with adults, several intervention studies have shown that reducing sedentary behaviors may be an effective way of promoting weight loss in overweight children (7–10).

To our knowledge, TV viewing behavior has not been explored among individuals who have been successful at long-term weight loss maintenance. The National Weight Control Registry (NWCR), a sample of adults who have lost at least 30 lb ( $\approx 13.6$  kg) and maintained the weight loss for at least 1 year, provides a unique opportunity to examine predictors of long-term weight maintenance. Individuals in

<sup>1</sup> Nonstandard abbreviations: TV, television; NWCR, National Weight Control Registry.

the NWCR have been reported to use several strategies to maintain their weight loss, including consuming a low-fat and low-calorie diet, eating breakfast regularly, participating in high levels of activity, and weighing themselves frequently (11–13). This study describes the role of TV viewing in long-term maintenance of weight loss among NWCR members. A primary aim was to determine whether TV viewing was a relatively infrequent behavior among these successful weight losers. Another objective was to compare the extent to which TV viewing was associated cross-sectionally and prospectively with weight status, independently of physical activity levels.

## Research Methods and Procedures

### Participants

All participants were part of the NWCR, an observational study of successful long-term maintenance of weight loss. Individuals  $\geq 18$  years of age who had maintained at least a 13.6 kg weight loss for at least 1 year were recruited from coverage and advertisements in various media, including newspaper, magazine, radio, and TV. Individuals who showed interest by contacting the NWCR were mailed an informed consent form. Two main variables of interest, TV viewing and weight, were assessed at the entry into the NWCR (i.e., baseline) and at 1 year. The assessment of TV viewing was initiated a few years after the start of the NWCR. For this study, the sample was limited to participants who completed the question regarding TV viewing and weight at entry into the NWCR, had reached the 1-year assessment, completed the TV viewing and weight questions at the 1-year follow-up assessment, and denied pregnancy at both time-points.

### Measures

On entry into the Registry, participants completed and returned by mail a packet of self-report questionnaires. Participants repeated the completion of the packet at the 1-year follow-up. The following variables are included in this report.

**Demographic Information and Weight History.** Participants provided demographic information, including age, sex, ethnicity, education level, employment status, and marital status. Participants also provided information about their weight loss history, including their lifetime maximum weight, total weight loss, current body weight, and current height. BMI was computed using both current and maximum body weight. Duration of the criterion weight loss (i.e., a minimum of 13.6 kg) was computed by subtracting 13.6 kg from their maximum lifetime weight and calculating the number of months participants had stayed at or below the reduced weight. Weight change was computed by subtracting weight measured at the baseline assessment from the 1-year assessment weight. Previous research with

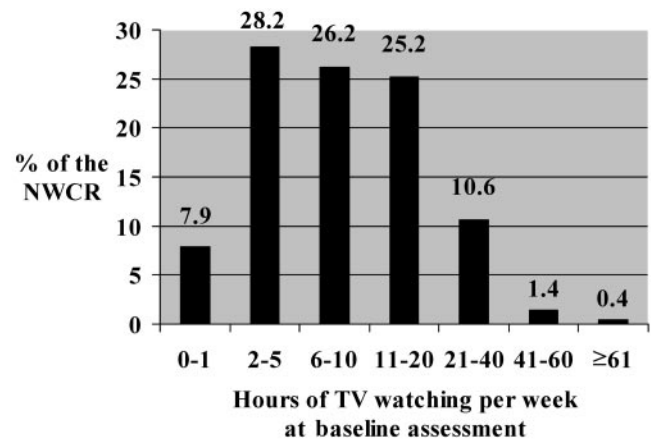


Figure 1: Frequency distribution of participants reporting the number of hours viewing TV per week on entry into the NWCR.

the NWCR showed that self-reported weight is sufficiently reliable and valid (14).

**TV Viewing.** Participants responded to one question on the average number of hours of weekly TV viewing: “On average, how many hours per week do you spend watching TV/cable/VCR?” Seven time categories were used: 1 = 0 to 1 h/wk, 2 = 2 to 5 h/wk, 3 = 6 to 10 h/wk, 4 = 11 to 20 h/wk, 5 = 21 to 40 h/wk, 6 = 41 to 60 h/wk, and 7 =  $\geq 61$  h/wk.

**Physical Activity.** Participants provided information about current overall physical activity with the Paffenbarger Physical Activity Questionnaire (15). This measure assesses daily number of city blocks walked, number of flights of stairs climbed, and time engaged in a myriad of light, moderate, and heavy exercise and recreational activities. This information was integrated to estimate the amount of energy expended (kilocalories) during the previous week.

**Dietary Intake.** Participants provided information about eating habits and dietary intake by completing the Block Food Frequency Questionnaire (16). This instrument provides reliable estimates of daily intake of energy and percentage of daily energy from various macronutrients, including fat, protein, and carbohydrates. Participants report on their usual serving size and frequency of consumption of a variety of foods. For this study, estimates of total energy intake (kilocalories) and percentage of total calories from fat and sweets (e.g., cookies, ice cream, candy) were examined.

### Statistical Analysis

All analyses were conducted using SPSS for Windows Version 11.0 (17). One-way ANOVA and  $\chi^2$  statistics were used to compare low TV/VCR viewers ( $\leq 10$  h/wk) with high TV/VCR viewers ( $> 10$  h/wk) on demographic, weight, and behavioral variables. The 10-hour cut-off was

**Table 1.** Demographic, weight history, physical activity, and dietary indices by category of television (TV) viewing

Characteristic	TV viewers		<i>p</i> value*
	Low (≤ 10 hours/wk)	High (>10 hours/wk)	
Demographics			
Gender (% female)	78.1%	77.5%	0.95
Ethnicity (% Caucasian)	94.7%	95.2%	0.99
Mean age in years (SD)	45.9 (11.8)	51.3 (13.4)	0.00
Highest education status (% completed)			
High school	7.7%	13.6%	0.00
Some college	27.3%	25.6%	0.48
College	27.4%	25.8%	0.51
Graduate or Professional	31.9%	26.0%	0.02
Employment status (% currently employed)	82.3%	62.2%	0.00
Marital status (% currently married)	62.9%	69.0%	0.02
Weight characteristics at baseline assessment (SD)			
Current weight (kg)	70.1 (14.7)	71.6 (16.2)	0.07
Maximum BMI	36.3 (9.1)	36.5 (8.7)	0.73
Duration of weight loss in months	75.0 (96.5)	82.7 (102.3)	0.16
Weight loss from maximum (kg)	33.1 (19.2)	32.1 (17.5)	0.34
Weekly physical activity in kcal (SD)			
Total	2742 (2387)	2166 (1907)	0.00
Light	160 (430)	123 (353)	0.10
Moderate	683 (1246)	553 (1057)	0.04
Heavy	985 (1568)	711 (1373)	0.00
Dietary intake (SD)			
Total daily calories	1422 (680)	1398 (565)	0.52
% of daily calories from fat	26% (10)	28% (11)	0.01
% of daily calories from sweets	5% (6)	6% (7)	0.05

SD, standard deviation.  
\* *p* values based on chi-square analyses.

selected because it was the median value in this study. Moreover, Hu et al. (6) reported that initially healthy individuals viewing >10 h/wk were at significantly increased risk of becoming obese and developing type 2 diabetes over a 6-year period.

The correlation between change in weight and change in TV viewing, eating, and exercise behavior over the year of follow-up was analyzed by Pearson correlations. Multiple linear regression analyses were used to determine whether weight gain from baseline to 1 year was related to the changes in TV viewing over this time period and whether this effect was independent of the other behavior changes. Change in TV viewing was examined in combination with

change in physical activity or changes in dietary variables. All baseline and change variables were entered as continuous variables in predicting weight change. Maximum lifetime BMI, duration of weight loss maintenance, and magnitude of weight loss were entered as covariates in these analyses.

## Results

### *Demographic and Weight History Characteristics*

A total of 1884 participants enrolled in the NWCR after the TV questionnaire was added to the assessment packet and had reached the 1-year assessment in the NWCR. Of

**Table 2.** Changes in TV viewing, physical activity, diet, and weight from baseline to 1-year assessment

Behavior	Baseline	1-year	Mean change	Correlation with weight change	
				Baseline value	Change in behavior
TV viewing*	3.08 ± 1.2	3.07 ± 1.3	−0.01	0.04	0.09§
Physical activity (kcal/wk)	2523.7 ± 2239.7	2398.4 ± 2841.0	−125.4	0.00	−0.10†
Diet					
Total calories	1440.8 ± 648.5	1428.7 ± 627.6	−12.1	0.10§	0.06‡
% kcals from sweets	5.3 ± 6.2	6.2 ± 6.8	0.9†	0.01	0.07‡
% kcals from fats	26.4 ± 10.2	27.3 ± 10.0	0.9†	0.07‡	0.10§
Weight (kg)	70.7 ± 15.3	72.9 ± 16.6	2.2†	0.07§	—

\* 1 = 0 to 1 hour/wk, 2 = 2 to 5 hours/wk, 3 = 6 to 10 hours/wk, 4 = 11 to 20 hours/wk, 5 = 21 to 40 hours/wk, 6 = 41 to 60 hours/wk, and 7 = 61 or more hours/wk.  
†  $p < 0.001$ .  
‡  $p < 0.04$ .  
§  $p < 0.01$ .

those, 1422 individuals (75.5%) completed baseline and 1-year follow-up questions on TV viewing and weight status. Participants who did not respond to the main variables of interest differed significantly ( $p < 0.05$ ) from those participants with complete data in terms of several demographic and weight history variables. Individuals with complete data were more likely to be younger, more highly educated, and married, to have had lower BMI at baseline and lower maximum lifetime weight, and to have lost less weight from their lifetime maximum weight and maintained their weight loss for a longer duration. Participants with missing data did not differ from those with complete data in terms of sex or ethnicity ( $p > 0.05$ ).

The mean age of the sample was  $47.9 \pm 12.7$  years, and the majority were women (77%), white (95%), married (65%), highly educated (57% received a college or higher level degree), and currently employed (74%). At baseline, participants averaged  $70.7 \pm 15.3$  kg and had a BMI of  $24.8 \pm 4.6$  kg/m<sup>2</sup>. Participants reported that their mean lifetime maximum weight and BMI were  $103.6 \pm 27.6$  kg and  $36.4 \pm 8.9$  kg/m<sup>2</sup>, respectively. The mean weight loss from lifetime maximum weight was  $32.8 \pm 18.9$  kg. The mean duration of maintaining the criterion weight loss was  $77.9 \pm 98.8$  months, or 6.5 years.

#### Television/VCR Viewing at Entry into the Registry

Figure 1 shows the percentage of participants who reported the seven time categories used to describe mean hours spent watching TV/VCR on entry into the NWCR. More than one third (36.1%) reported watching  $\leq 5$  h/wk, and 26.2% reported watching 6 to 10 h/wk. As seen in Table 1, high TV/VCR viewers ( $>10$  h/wk) were significantly

( $p < 0.05$ ) older and less educated, and were more likely to be currently unemployed and married. High TV/VCR viewers also engaged in less total, moderate, and heavy intensity weekly physical activity and consumed a greater percentage of their total daily calories from fat. Controlling for demographic differences did not attenuate the significant differences between high and low TV/VCR viewers in total weekly physical activity and daily intake of fat but removed the difference in moderate and heavy physical activity.

#### Prospective Associations between Baseline and Changes in TV/VCR Viewing and Weight Regain

Registry participants reported an average weight gain of 2.2 kg over the year of follow-up. The amount of TV/VCR viewing did not change over the year for the sample as a whole. However, there were marginally significant decreases in physical activity ( $p = 0.056$ ) and significant increases in percentage of calories from fats ( $p = 0.001$ ) and sweets ( $p = 0.001$ ) over the year of follow-up (Table 2). Moreover, increases in TV/VCR viewing were significantly correlated with increases in percentage of calories from fats ( $r = 0.09$ ,  $p < 0.01$ ) but not with changes in physical activity ( $r = -0.03$ ,  $p = 0.23$ ), total calories ( $r = 0.06$ ,  $p = 0.06$ ), or percentage of calories from sweets ( $r = -0.01$ ,  $p = 0.72$ ). When examining correlations between behavior changes and weight changes, results showed that increases in TV/VCR viewing ( $r = 0.09$ ,  $p < 0.01$ ), decreases in physical activity ( $r = -0.10$ ,  $p < 0.001$ ), and increases in percentage of calories from fat ( $r = 0.10$ ,  $p < 0.01$ ) and sweets ( $r = 0.07$ ,  $p = 0.02$ ) were each significantly associated with weight regain.

**Table 3.** Results of regressing baseline and one-year changes in physical activity, dietary behaviors, and television viewing on one-year weight change

Variable	Standardized $\beta$	t	p value
Model 1†			
Baseline physical activity	−0.017	−0.554	0.580
Change in physical activity	−0.080	−2.646	0.008
Baseline caloric intake	0.145	4.415	0.000
Change in caloric intake	0.112	3.396	0.001
Baseline TV	0.085	2.677	0.008
Change in TV time	0.111	3.504	0.000
Model 2‡			
Baseline physical activity	0.007	0.239	0.811
Change in physical activity	−0.071	−2.350	0.019
Baseline % calories from fat	0.099	3.084	0.002
Change in % calories from fat	0.119	3.755	0.000
Baseline TV	0.074	2.324	0.020
Change in TV time	0.108	3.396	0.001
Model 3§			
Baseline physical activity	−0.016	−0.518	0.605
Change in physical activity	−0.074	−2.415	0.016
Baseline % calories from sweets	0.035	1.104	0.270
Change in % calories from sweets	0.088	2.808	0.005
Baseline TV	0.081	2.532	0.011
Change in TV time	0.123	3.885	0.000

\* Models 1–3 controlled for the following covariates: Maximum BMI, duration of weight loss maintenance, and magnitude of weight loss.

† Model 1:  $F(9,1054) = 10.94$ ,  $p < 0.001$ .

‡ Model 2:  $F(9,1054) = 10.41$ ,  $p < 0.001$ .

§ Model 3:  $F(9,1054) = 9.25$ ,  $p < 0.001$ .

To determine the independent effects of these behaviors on weight regain, three linear regression analyses were conducted, adjusting for baseline predictors (i.e., maximum BMI, duration of weight loss maintenance, and magnitude of weight loss). Variables entered into all three models were baseline and changes in both TV viewing and physical activity (kilocalories per week). Total caloric intake (kilocalories per day), percentage of calories from fat, and percentage of calories from sweets were entered as predictors in the first, second, and third models, respectively. As seen in Table 3, results from all of the three models indicated that higher baseline TV viewing, increases in TV viewing, and decreases in physical activity were each independently and significantly associated with 1-year weight regain. Of the dietary variables, results from the three analyses indicated that higher baseline caloric intake, increases in caloric intake, baseline percentage of calories from fat, increases in percentage of calories from fat, and increases in percentage of calories from sweets were significantly associated with

1-year weight regain. Thus, the association between TV viewing and weight regain was independent of changes in both physical activity and dietary intake.

For descriptive purposes, we compared the magnitude of weight regain from entry into the Registry until 1-year follow-up associated with worsening vs. improved TV viewing and eating or exercise behaviors. Changes in each of the variables were categorized for these descriptive analyses as follows: 1) TV viewing (increase  $\geq 1$  category/no change/decrease  $\geq 1$  category), 2) physical activity (increase  $> 500$  kcal/no change/decrease  $> 500$  kcal), 3) changes in total caloric intake (divided into tertiles), and 4) changes in percentage of calories from fat intake (divided into tertiles). As shown in Figure 2, the combination of decreasing physical activity and increasing TV viewing resulted in a  $4.08 \pm 6.2$  kg weight regain; in contrast, those individuals who increased physical activity and decreased TV viewing gained only  $1.61 \pm 7.4$  kg. Similarly, the combination of increasing total caloric intake and increasing



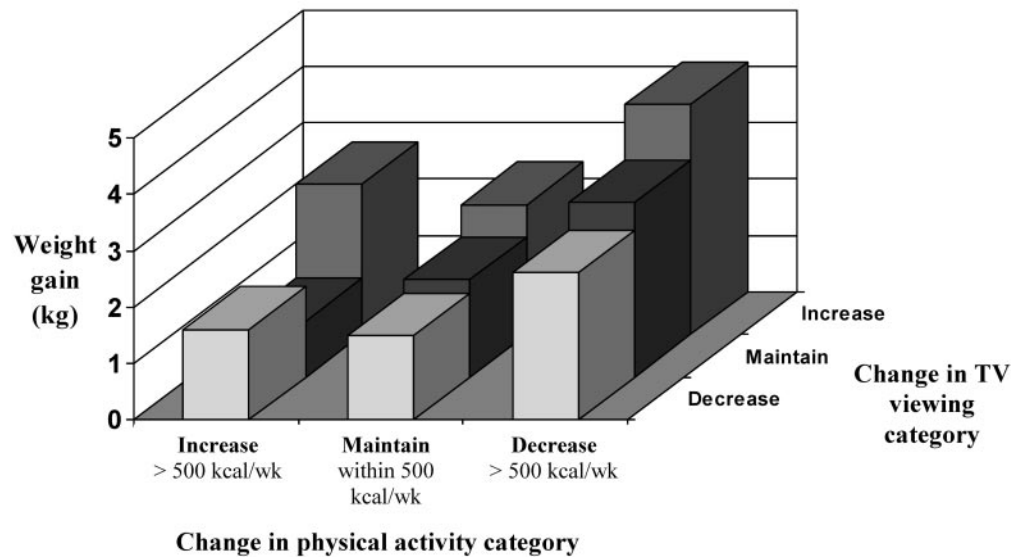


Figure 2: Independent and joint effects of changes in TV viewing and physical activity from baseline to 1-year assessment on change in weight from baseline to 1-year assessment. The sample size across cells are as follows: (1) increase TV and decrease exercise:  $n = 117$ , (2) maintain TV and decrease exercise:  $n = 255$ , (3) increase TV and increase exercise:  $n = 78$ , (4) decrease TV and decrease exercise:  $n = 122$ , (5) increase TV and maintain exercise:  $n = 137$ , (6) maintain TV and maintain exercise:  $n = 281$ , (7) decrease TV and maintain exercise:  $n = 131$ , (8) maintain TV and increase exercise:  $n = 181$ , and (9) decrease TV and increase exercise:  $n = 94$ .

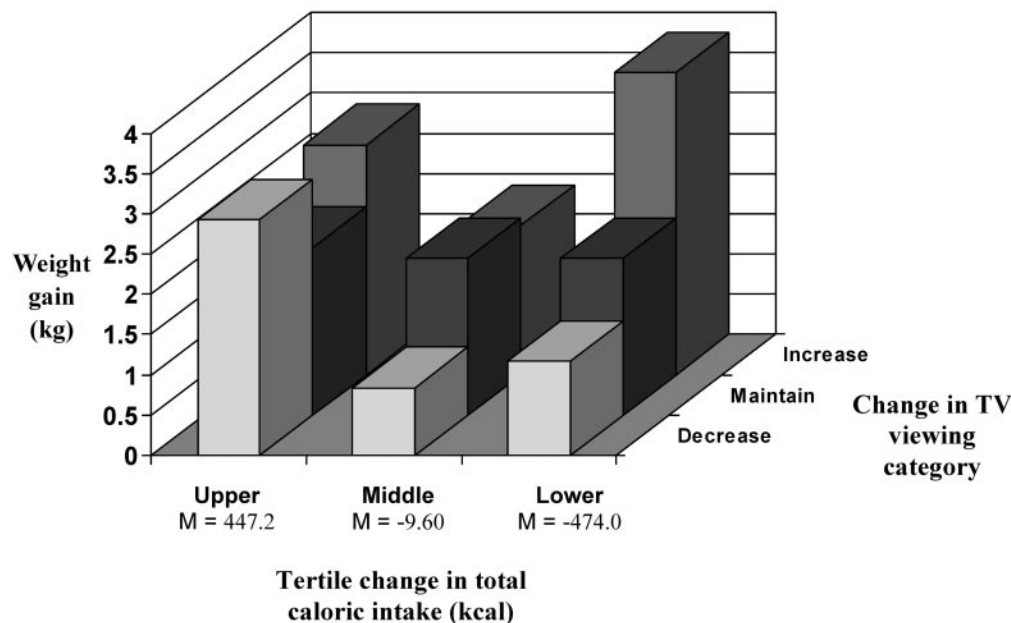


Figure 3: Independent and joint effects of changes in TV viewing and total caloric intake from baseline to 1-year assessment on change in weight from baseline to 1-year assessment. The sample size across cells are as follows: (1) increase TV and increase total caloric intake:  $n = 89$ , (2) maintain TV and increase total caloric intake:  $n = 185$ , (3) decrease TV and increase total caloric intake:  $n = 90$ , (4) increase TV and maintain total caloric intake:  $n = 89$ , (5) increase TV and decrease total caloric intake:  $n = 75$ , (6) maintain TV and decrease total caloric intake:  $n = 191$ , (7) decrease TV and decrease total caloric intake:  $n = 98$ , (8) maintain TV and maintain total caloric intake:  $n = 191$ , and (9) decrease TV and maintain total caloric intake:  $n = 84$ .

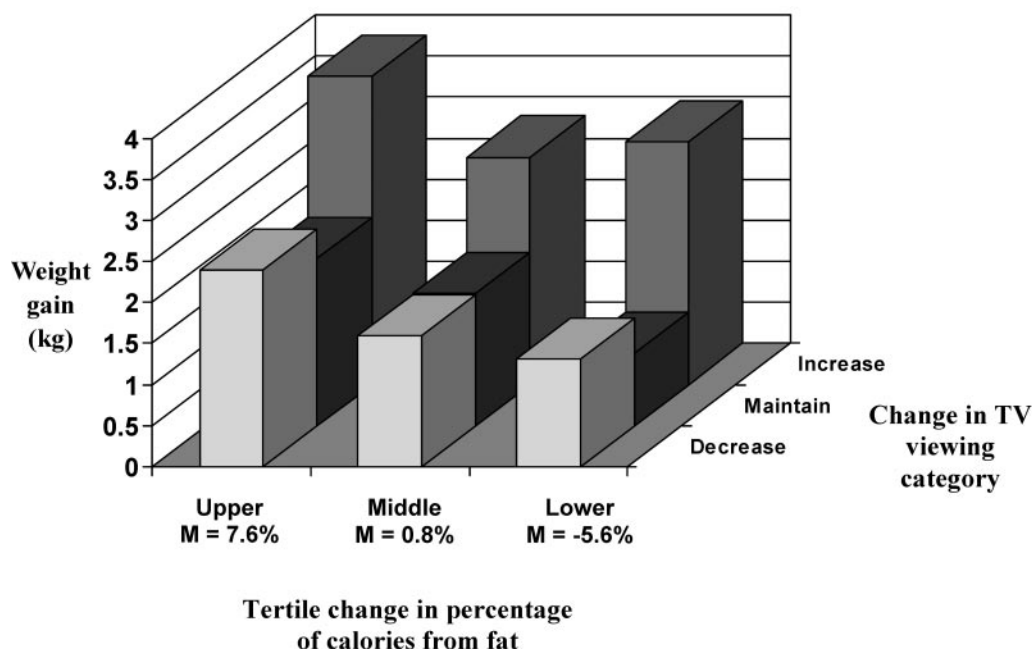


Figure 4: Independent and joint effects of changes in TV viewing and percentage diet from fat from baseline to 1-year assessment on change in weight from baseline to 1-year assessment. The sample size across cells are as follows: (1) increase TV and decrease percentage diet from fat:  $n = 71$ , (2) maintain TV and decrease percentage diet from fat:  $n = 188$ , (3) increase TV and increase percentage diet from fat:  $n = 94$ , (4) decrease TV and decrease percentage diet from fat:  $n = 106$ , (5) increase TV and maintain percentage diet from fat:  $n = 88$ , (6) maintain TV and maintain percentage diet from fat:  $n = 190$ , (7) decrease TV and maintain percentage diet from fat:  $n = 87$ , (8) maintain TV and increase percentage diet from fat:  $n = 189$ , and (9) decrease TV and increase percentage diet from fat:  $n = 79$ .

TV viewing resulted in a  $2.86 \pm 5.9$  kg regain; in contrast, those individuals who decreased total caloric intake and decreased TV viewing gained only  $1.17 \pm 4.8$  kg (Figure 3). The combination of increasing the percentage of calories from fat and increasing TV viewing resulted in a  $3.75 \pm 6.7$ -kg regain, whereas those individuals who decreased percentage of calories from fat and decreased TV viewing gained only  $1.31 \pm 4.7$  kg (Figure 4). Too few participants ( $n = 36$  to  $40$ ) reported detrimental changes on combinations of three of the behaviors for meaningful comparisons to be conducted.

## Discussion

This prospective study examined the role of TV viewing in weight maintenance and regain among individuals in the NWCR, a large cohort of successful weight loss maintainers. Previous research has identified several distinguishing behaviors among individuals in the NWCR, including consuming a low-fat and low-calorie diet, eating breakfast regularly, participating in high levels of activity, frequent self-monitoring of body weight, and maintaining dietary consistency over time (11–13). Results from this study suggest that minimizing TV/VCR viewing is another key strategy among many of these successful weight loss main-

tainers. A relatively high proportion (63.5%) of individuals in this sample reported watching  $\leq 10$  h/wk on entry in the NWCR. More than one third of the sample (38.5%) reported watching  $< 5$  h/wk, whereas only 12.5% watched  $\geq 21$  h/wk. These findings are in stark contrast to the typical TV viewing behavior of American adults, who spend an average of 28 h/wk watching TV (2). Thus, it is reasonable to conclude that allocating a minimal amount of discretionary leisure time to engage in this form of sedentary behavior may be an important strategy for maintaining weight loss over the long term.

Despite the fact that the primary criterion for inclusion in the NWCR is a successful history of weight loss maintenance, prior research has shown that a significant proportion of NWCR participants (35%) gain weight during the year after enrollment (14). In this study, the 1-year follow-up assessment revealed a mean weight regain of 2.2 kg (4.9 lb) for the sample. Examining predictors of weight regain, we found that baseline levels of TV viewing, increases in TV viewing, baseline caloric intake, increases in caloric intake, baseline dietary fat intake, increases in dietary fat intake, increases in dietary sweet intake, and decreases in physical activity were independent predictors of 1-year weight regain. Although the effects of change in TV viewing on weight gain have to be mediated by changes in physical

activity and/or dietary factors, it remains unclear which part of the energy balance equation is being affected by TV viewing in adults. Findings from this study are consistent with a growing body of cross-sectional and prospective research showing that TV viewing and physical activity are independent correlates of weight status (3,4,6). Less research has examined the role of dietary variables and TV viewing on weight change. Studies of overweight adults (18) and children (19–21) have reported significant relationships between TV viewing and increased food consumption. However, the potential mediating role of dietary factors in TV-related weight gain awaits further study.

Although the use of a large, prospective cohort is a strong point in this study, it is important to note several limitations. The questionnaires used in the study were based entirely on self-report and did not include more specific assessments of diet (e.g., eating while watching TV, between-meal snacking). TV time was assessed with just one question about general TV viewing; future research should include questions about weekends and weekdays and other “screen time” sedentary behaviors (e.g., video game and computer use). Participants in the NWCR volunteer to join the study and, thus, may be healthier, more highly educated, and more motivated than the general population of successful weight loss maintainers. Because individuals in this study are unusual in the magnitude and duration of their successful weight loss maintenance, the results of this study may not generalize to individuals who are maintaining a more modest weight loss. In addition, although the prospective analyses suggest that increases in TV watching led to weight regain, it is also possible that weight regain may have led to increased TV watching. Because this study did not use an experimental design, the conclusion that reducing TV time will result in or cause weight loss maintenance is not warranted. Several other correlational studies have found weak or no associations between TV viewing and overweight (22–26). Interventions in school settings targeting TV viewing in children have been found to significantly reduce BMI (8,9); however, experimental studies targeting reductions in TV viewing among adults attempting to lose weight are clearly needed.

In conclusion, we found that individuals who are successful at maintaining weight loss over the long term are likely to spend a relatively minimal amount of their time watching TV. In addition to engaging in high levels of physical activity and modifying dietary intake, reducing common sedentary behaviors, such as watching TV, may help to promote long-term weight loss maintenance.

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